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Enforcement and Compliance Assurance (2201)
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EPA

# Superfund At Work

Hazardous Waste Cleanup Efforts Nationwide

## Sand Creek Industrial Site Profile

**Site Description:** Former pesticide manufacturing facility, petroleum refinery, small municipal landfill, and acid waste disposal pits

**Site Size:** 300 acres

**Primary Contaminants:** Volatile organic compounds, pesticides, and arsenic

**Potential Range of Health Risks:** Toxicity causing skin and eye irritation, respiratory distress, central nervous system disorders, increased risk of cancer

**Nearby Population:** 25 people within 1 mile

**Year Listed on NPL:** 1982

**EPA Region:** 8

**State:** Colorado

**Congressional District:** 4

*Success in Brief*

## Innovative Technologies Accelerate a "Brownfields Redevelopment"

Using a combination of leading-edge approaches, hazardous wastes from pesticide manufacturing, oil refining, and improper landfilling have been cleaned up at the Sand Creek Industrial site in Commerce City, Colorado.

In 1994, the U.S. Environmental Protection Agency (EPA) and the Colorado Department of Public Health and Environment (CDPHE) completed cleanup of the site using a combination of innovative technologies including soil vapor extraction (SVE) and low-temperature thermal treatment (LTTT). These innovative technologies were chosen because of their low overall cost and demonstrated efficiency in eliminating site contaminants. EPA and CDPHE also applied an aggressive and streamlined approach to ensure that the selected remedy remained under budget and on schedule.

Companies or individuals who had been found legally associated with the site's contamination – either because they contributed hazardous wastes or now own the property – included the LC Corporation (LCC), Burlington Northern Railroad Company, and Browning-Ferris Industries, Inc. These companies effectively remediated contamination at the site during the past several years.

**View of the Sand Creek Industrial site** during the early stages of cleanup.

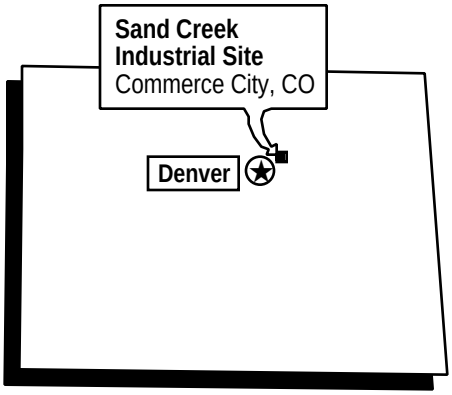
## The Site Today

Reuse of formerly contaminated industrial properties is known as "Brownfields Redevelopment" – a high priority for EPA. With cleanup efforts complete in several areas and new construction under way on part of the site, EPA expects that the site will return to productive use in the near future. Commerce City officials are currently working with EPA to remove obstacles to redevelopment.

# A Site Snapshot

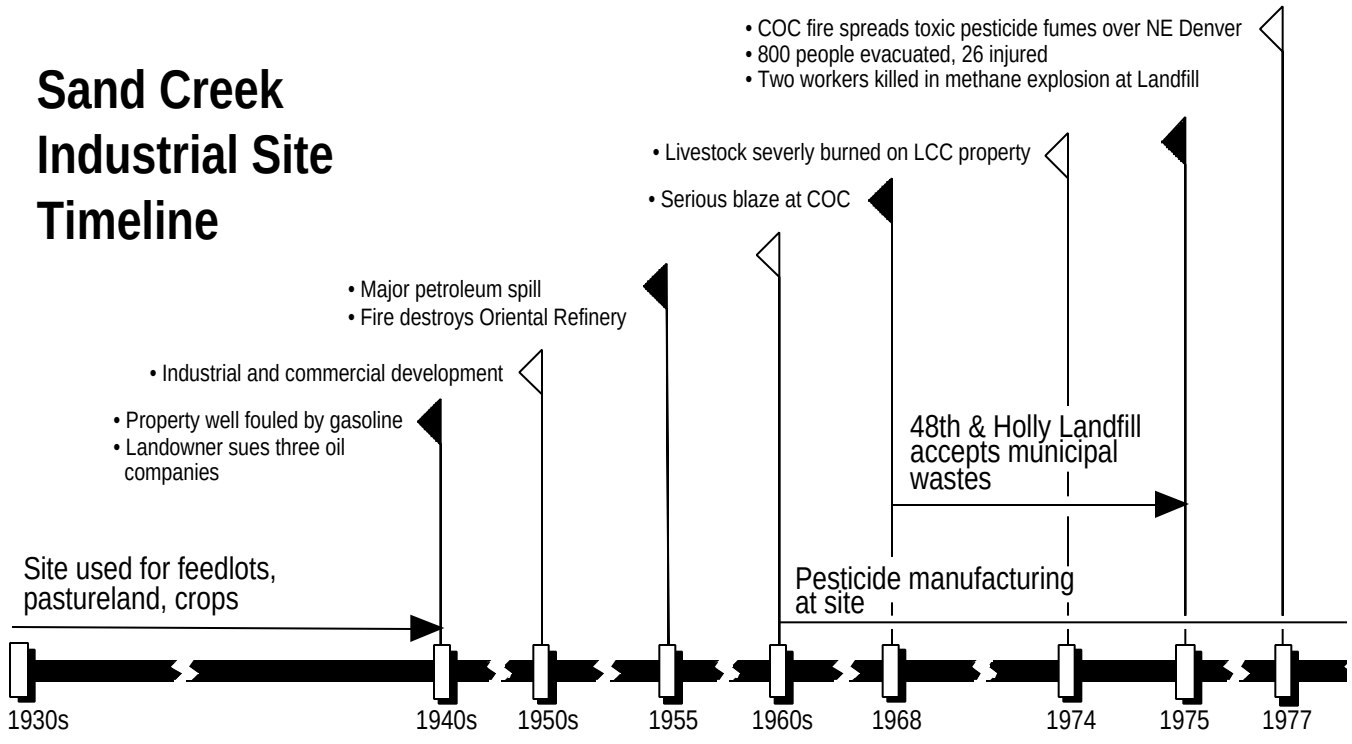
The 300-acre Sand Creek Industrial site is located in a commercial area about 7 miles northeast of downtown Denver. Four known entities polluted the site, including LCC, the Colorado Organic Chemical Company (COC), the 48th and Holly Landfill, and the Oriental Refinery. All four are inactive but each contributed to the site contamination in a variety of ways.

The site's 50-year history includes a fire that destroyed the refinery, a major spill of refined petroleum, two methane explosions that killed two workers, and a fire at a pesticide formulator that released fumes over northeast Denver and resulted in several firemen being hospitalized.




As early as 1968, state health agencies documented unsatisfactory waste management practices and worker safety conditions, particularly violations in storage and handling of flammable liquids. Ground water contaminants include various volatile organic compounds (VOCs) and arsenic; soil in some areas was contaminated with VOCs, pesticides, and arsenic.

## Sand Creek Industrial Site Timeline



# EPA Reverses Decades of Accidents, Mismanagement,

The earliest evidence of contamination at the site was discovered in the 1940s, when 26 inches of a "gasoline-type material" were found floating in a well on a nearby property. The landowner sued three oil companies operating near the property for causing the contamination, but the court was not persuaded that these companies were responsible.

According to aerial photographs, the site during the early 1950s was mostly cropland, pasture, feedlots for cattle, a pond, and wetlands. Industrial and commercial development continued throughout the 1950s and 1960s with the entrance of refineries and landfills.

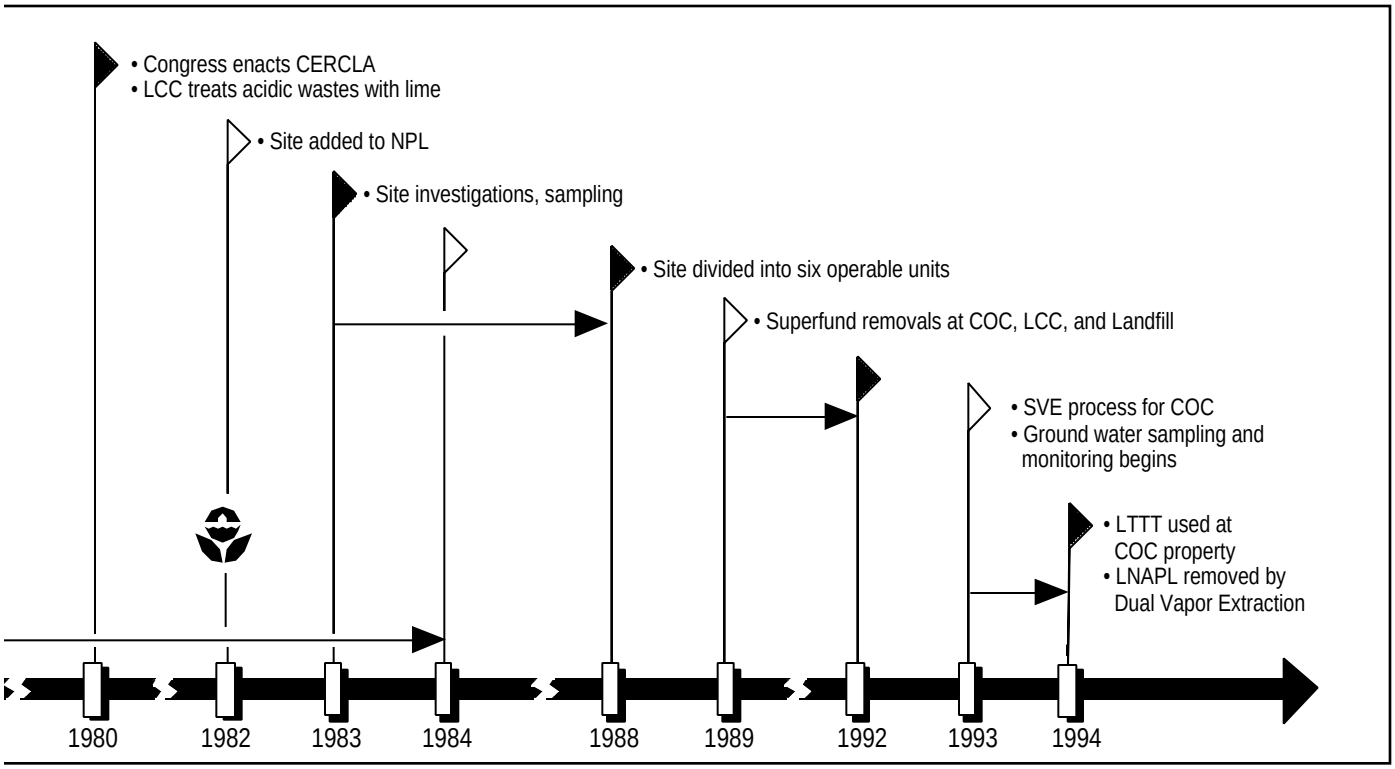
**Former Oil Refinery Reduced to Pile of Rubble**

Many serious fires occurred on the site, the first of note in 1955 that destroyed the Oriental Refinery. A major spill of refined petroleum had long-lasting environmental consequences. In 1980, EPA found diesel fuel in several ground water monitoring wells and petroleum-contaminated soil at depths to 28 feet, both originating from the 1955 spill.

**Toxic Fumes over Northeast Denver**

In 1968, the COC part of the site sustained a serious blaze and again in 1977. That fire at a pesticide formulator forced the evacuation of more than 800 people and at least 26 were treated after they inhaled toxic parathion fumes. Afterward, the company was cited for a series of violations involving unsatisfactory waste management practices and unsafe working conditions.

COC had been manufacturing pesticides beginning in the 1960s and intermittently for 20 years. By 1984, the COC property included six buildings, 10 above ground tanks, and an uncovered area that was previously used for storage. The property also contained 120 drums that were unlabeled, corroded, bulged, and leaking. In combination, the fires and unacceptable waste management methods left the property contaminated with pesticides, arsenic, and VOCs.



# and Poor Waste Disposal Practices

**Livestock Severely Burned**

The LCC part of the site was used to store and neutralize spent acidic wastes from Shell's herbicide chemical plant at the Rocky Mountain Arsenal. In 1974, livestock that strayed on the property suffered severe chemical burns when they wandered across the acid pits. Most of this contamination was removed in 1980 when LCC mixed and neutralized the acidic wastes with lime.

**Methane Explosion Takes Two Lives**

The 48th and Holly Landfill accepted demolition debris and domestic refuse from 1968 to 1975. As the wastes decomposed, they generated methane gas. In 1977, two workers were killed and five injured by an explosion during construction of a water conduit; a study by CDPHE concluded that the explosion occurred when methane migrated from the landfill.

**Operators Abandon Sites**

With the advent of environmental regulation in the early and mid-1970s, many sites were abandoned by operators who found that upgrading their aging facilities to meet new performance standards could not be economically justified. In addition, thousands of other problem industrial sites existed around the country, prompting Congress to enact the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA). In 1982, EPA added Sand Creek to the National Priorities List of sites requiring comprehensive cleanup under the new Superfund program.

**The site can now return to productive use**

**EPA Takes Over**

A series of studies completed in 1988 recommended dividing the site into a series of *operable units* (OUs), a method of segregating the site by geographic area or type of contaminant to make the cleanup process more manageable. At Sand Creek, these OUs included:

1. Deep soil and contaminated buildings on part of the COC property
2. The LCC property
3. Sediments, soil, surface water, and ground water near the 48th and Holly Landfill
4. Site-wide ground water
5. Shallow soil in the COC property
6. Methane gas from the 48th and Holly Landfill.

Investigations and cleanup at OUs 1, 2, 4, and 5 were completed as "fund-lead" sites: federal and state agencies used Superfund and state money to oversee and conduct cleanup. The other OUs were investigated and cleaned up using private funds with supervision by the regulatory agencies.

Today, most of the contaminated soil is gone. About 2,000 cubic yards of debris, including four buildings, four rail cars, two concrete tanks, and 13 steel tanks have been hauled away. Between October 1993 and July 1994, EPA used the innovative SVE process at OU 1 to remove about 170,000 pounds of contamination from deep soil.

Nearly all of the acidic wastes at OU 2 had been treated in 1980 by LCC. EPA concluded that no additional work to control contamination was needed there.

Ground water sampling under OU 4 found a plume of light non-aqueous phase liquids (LNAPLs) comprised of petroleum products floating on the water beneath the northwest portion of the site. The LNAPLs were removed from atop the ground water using a combination of SVE and dual vapor extraction technologies.

Between June and August 1994, EPA operated a LTTT system at the site to clean up more than 8,000 tons of contaminated soil at OU 5.

Other approaches at Sand Creek included *institutional controls* such as zoning restrictions and bans on drilling wells. Additional approaches under OUs 3 and 6 include maintenance of landfill cover and erosion control, and a landfill gas extraction system that collects, condenses, and flares methane gas.

# Leading-Edge Technology at the Sand Creek Site

Innovative technologies such as those used at the Sand Creek Industrial site have many advantages over more conventional approaches, including cost, speed, and thoroughness. Three of the innovative technologies included SVE, dual vapor extraction, and LTTT to reduce contamination on site.

The Soil Vapor Extraction (SVE) process used a "closed loop" system to flush contaminants from soil with pressurized air and a vacuum to extract contaminated gases through a series of wells. Specifically, air under low pressure was pumped into the soil through a system of horizontal and vertical wells, and the contaminants were extracted under a light vacuum. This circulating air drew VOCs (which evaporate easily) from the soil and pulled them to the surface, where a catalytic oxidizer destroyed the contaminants. The treated air was then pumped back into the soil. Since the air was heated, it enhanced the removal of contaminants remaining in the soil. High- capacity carbon filters also removed contaminants from the air stream.

Contaminants were separated further by the circulating air through condensation. The technology was successful in removing more than 5,000 pounds of the primary contaminants and 165,000 pounds of pollutants considered less threatening. Dual Vapor Extraction, an adaption of SVE, was used to remove and treat the layer of LNAPLs (vapor and liquid phases) that overlies the ground water under a portion of operable unit 4.

### Why Use SVE?

Technologies such as SVE are being used with increasing frequency around the country to clean up soil lying above the water table (geologically known as the unsaturated zone). SVE is appealing because the technology:

- Works right on the site so that little disturbance is needed and the public is not exposed to the contaminated soil being hauled elsewhere for treatment
- Can treat large volumes of soil efficiently and at reasonable cost
- Is commercially available and has been shown to treat VOCs and some pesticides
- Is easily installed and uses standard, readily available equipment so that cleanup can begin quickly
- Emits no contaminants to the atmosphere
- Eliminates the cost of burying contaminated soil in landfills.

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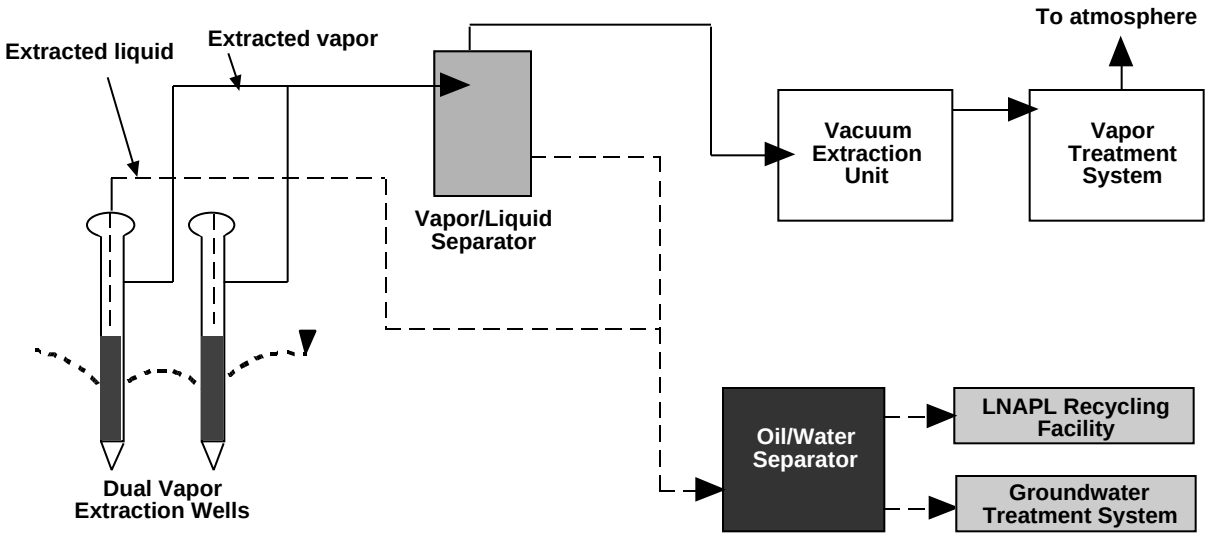
**Dual Vapor Extraction (DVE) System**



# Leading-Edge Technology

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**Low Temperature Thermal Treatment**

LTTT vaporizes volatile and semivolatile organic compounds from soil, sludges, and other solids. At the Sand Creek Site, engineers used a relatively low temperature of about 500 to 625 degrees Fahrenheit to vaporize pesticides. No by-products of combustion formed because the solids were heated but not actually burned.

To release contaminants such as pesticides, the excavated soil was heated in a chamber resembling a clothes dryer and the contaminants evaporated from the soil. The evaporated contaminants were collected and treated by activated carbon filters. Dust and other particulates were removed or controlled with activated carbon and other filtering devices such as cyclones, baghouses, or venturi scrubbers. Only clean water vapor and treated evaporation gases were released to the atmosphere in compliance with state and federal air pollution control requirements. In addition, water was sprayed on the soil to control dust. The clean soil was then backfilled on site.

The LTTT technology can be adapted to destroy additional contaminants and can be used for both high and low contaminant concentrations. LTTT operates at lower temperatures and uses less fuel than incinerators.

# Success at Sand Creek

Contamination at the Sand Creek Industrial site was the result of decades of accidents, mismanagement, and poor waste disposal practices that resulted in serious environmental degradation. Through the combined efforts of EPA, CDPHE, and responsible parties, the site can now return to productive use.

Cleanup at the site was completed on schedule and below cost estimates. Site management included a combination of accelerated site study techniques. The accelerated site study included the use of "focused" landfill cleanup evaluations and statistics for pesticide contaminated soil sampling. In addition, the use of innovative technologies allowed remediation to proceed more quickly and at lower cost than had conventional technologies been applied.

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